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ABSTRACT

Noting the importance of agriculture in a developing nation, this manual provides primary school teachers with ideas for lessons and activities that can be taught in the school garden setting to improve students' application of skills acquired in class. The guide provides examples of specific lesson plans in science, math, social studies, and English language. It includes lessons for three terms adapted to crops viable for each of those seasons. It covers planning, site selection, soil science, planting and cultivation, harvesting, preserving, and marketing. The first part of the guide presents six class syllabi, including main ideas, specific topics and related activities for each class stage. Activities include finding examples of specific plants in the village or at the market, learning about tools, and experimenting with growing conditions. The second part of the guide offers guidelines for planning and developing the curriculum and discipline for teaching in the garden. The third part includes several sample lesson plans with illustrations. A glossary of words frequently used in gardening is provided. (AP)

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Teaching in the Whole Garden

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INTRODUCTION

The purpose of this resource manual is to provide primary school teachers with ideas for lessons and activities which can be taught in the school garden. The importance of agriculture in a developing country cannot be overemphasized. Recently in Sierra Leone we have heard about the Green Revolution. What does this mean to the primary schools? What can teachers do to promote a Green Revolution? Is there room in the busy primary school timetable for agricultural experience and instruction? Is this a valid use of valuable instructional time and effort? How can a school garden become a stimulating and productive teaching tool rather than a draining demand for manual drudgery?

A better question is, "What is the purpose of a primary school education?" We should ask what we are educating students to do, and how the core curriculum can be made relevant to the lives of students.

To use a specific example, what is the purpose of learning to multiply or divide fractions? A student who masters fractions will be prepared to succeed in more advanced math. She may perform well on her Selective Entrance Examinations. Perhaps a student who masters fractions may someday move to a large town and hold an influential, lucrative position. Perhaps. But what is the immediate application of such a skill? What does a successful student of fractions bring to his family at the end of a school day? He or she can assist their family in determining the amount of seed needed for the family farm or kitchen garden. He can calculate the most efficient use of the land to be cultivated. She can keep accurate records of the proceeds from a harvest or predict the probable yield of a crop. This direct application of a skill acquired at school is the real measure of a school's contribution to a community.

Mr. R. K. Fornah, Class VII teacher at Weslyan Church of Sierra Leone Primary School, Binkolo, lists the following reasons for maintaining a school garden.

The Importance of a Garden to a School

1. The school farm is the laboratory for agricultural science where lessons taught in the classroom are practically demonstrated for better understanding.
2. Skills or techniques are taught by hearing, seeing and doing.
3. Practice on how crops are grown and taken care of is given to the pupil in the garden.
4. Simple experiments can be carried out in the garden by both pupils and teachers.

5. The garden stands out as a model of a successful farm to be admired by people within the community. This is motivating to the pupils.
6. The farm could be run on a profit basis.
7. Subjects such as math, health, social studies, English language and science can be taught in the garden.
8. The school makes use of its richest, most plentiful teaching aide: the natural environment.

This manual suggests learning activities that provide students opportunities to gain skills through direct experience and practical application. A school garden is an excellent teaching tool through which students can master and apply academic skills. Agricultural experience need not be isolated from the school curriculum. It, instead, can be a fine teaching tool for all subjects on the classroom timetable.

Teaching in the Whole Garden provides examples of specific lesson plans in science, health, math, social studies and English language. It includes lessons for three terms adapted to the crops viable in each of those seasons. It covers planning, site selection, soil science, planting and cultivation, harvesting, preserving and marketing. It is written with Primary Class V in mind, but is certainly not limited to that class. The lessons can be easily modified to accommodate all primary (and perhaps some secondary) classes.

In searching for a syllabus for primary school agriculture, four excellent ones were discovered. They were prepared by the Bunumbu Project, Makeni Teachers' College, Meals for Millions and the U.S. Peace Corps. The syllabus presented here is a compilation of all four since they each strengthen the other.

Teaching in the Whole Garden is intended as a working guide. Included are some suggestions to assist teachers in implementing an integrated curriculum. Teachers are encouraged to experiment, draw from their own experiences, to follow the lead of the students' interests, and to amend the book to suit their own circumstances.

CLASS ONE

TERM I

Topics	Activities
I. What is agriculture	Village walks to observe agricultural activities, including farms, kitchen gardens, and market.
A. Plants	
1. For food	
2. Other uses	
3. Local crops	
a. In farm and garden	
b. At the market	
B. Animals	Observe local animals.
1. Local animals	
2. Animal characteristics	
C. Tools	Examine common tools.
1. Names of common tools	
2. Their uses	
D. Soil	Take samples of soil from around the village. Describe the color and texture of the soil samples.
1. Where no plants grow	
2. Types of soil	
a. Color	
b. Textures	

TERM II

I. Parts of a plant	Examining plants.
A. Roots	
B. Stems	
C. Leaves	
D. Flowers	
E. Fruits and seeds	
II. Parts of plants we can eat	Display examples of each.
A. Roots	
B. Stems	
C. Leaves	
D. Flowers	
E. Fruits	
F. Seeds	
III. Animals we can eat	Find examples in village and market. Display pictures of each in classroom.
A. Fowl	
B. Fish	
C. Cattle	
D. Sheep/goats	
E. Bush beef	

TERM III

Topics	Activities
I. Needs of plants A. Water B. Air C. Sunlight D. Soil	Plant seeds in classroom. Binch (beans) or radish germinate quickly.
II. Garden maintenance A. Using tools B. Identification of weeds C. Identification of pests	Tend a small class garden plot.
III. Seeds A. Seeds we eat 1. Rice 2. Binch (beans) 3. Groundnuts	Find edible seeds in market. Make a classroom display.
B. Storing seeds 1. To grow 2. To eat	Talk about seed storage in home and community.

CLASS ONE
RELATED ACTIVITIES

SOCIAL STUDIES: Who works on farms? Who works in gardens? Who works in the market? Where do you find farms and gardens? Who makes tools? Where do we get seeds? Visit farms, gardens and markets.

MATH: How much do common foods cost in the market? Order common seeds from largest to smallest. Measure the growth of a seedling. Compare the weight of wet and dry soil. Order animals from largest to smallest. Make sets of edible plant parts: roots, leaves, fruits, seeds, etc. Count plants, animals, seeds and tools.

ENGLISH LANGUAGE: Vocabulary development: names of plants, animals and tools in English and local languages. Rhymes and finger plays about plants, animals, farmers and foods. Label seeds. Describe agricultural activities observed in the community. Describe a trip to the market. Place pictures of a growing plant in the proper order.

HEALTH: Why do we eat food? How do we store food? How do we clean food? Animals? Safe use of tools. Good foods for health. What do people, plants and animals all need to live and grow? *(air, water food)* Seeds we can eat.

CLASS TWO

TERM I

Topics	Activities
I. What is agriculture? A. Local crops B. Local animals 1. Domestic 2. Bush (wild)	Visit local farms. Invite farmers to speak to the class.
II. Tools A. Why we use a tool B. Names of common tools C. Their uses D. Care of tools	Do a simple task with and without a tool. Compare the results. Visit a blacksmith. Display local tools.
III. Soil A. Parts of soil 1. Rock, sand, clay 2. Leaves, roots 3. Insects, etc.	Examine various soils collected from around the village.
B. Good soil for plants	Plant seeds in various types of soil. Keep them in the classroom and observe and compare their growth.
IV. Planting seeds A. What is a seed B. Germination	Collect examples of seeds. Sprout a seed in wet paper. Observe its growth.

TERM II

I. Parts of a plant A. Roots B. Stems C. Leaves D. Flowers E. Fruits F. Seeds	Label a plant's parts. Identify the function of each part. Compare the parts of different plants, e.g., cassava root and garden egg root, etc.
II. The uses of plants' parts A. Plant parts to eat B. Other uses	Identify the parts of various plants we can eat. Identify the parts of plants used for other things, e.g., bush sticks, brooms, rope, baffas, cotton for country cloth, medicine, etc. Make books. Visit a weaver.
III. Garden maintenance A. Using tools B. Identification of weeds C. Identification of pests D. Watering	Tend a small class garden plot.

TERM III

Topics	Activities
I. Needs of plants A. Water B. Air C. Sunlight D. Soil	Plant seeds. Experiment with amounts of water, light, air and soil provided for plants.
II. Tools A. Names of tools B. Their uses	Use tools in school garden. Visit a blacksmith. Label pictures of tools.
III. Garden maintenance continued from Term II	Allow children to share harvest. Prizes for best produce.

CLASS TWO
RELATED ACTIVITIES

SOCIAL STUDIES: Invite a farmer to speak to the class. Visit farms, gardens and markets. Visit a blacksmith. Make brooms from local materials. Make bush rope. Visit a weaver. Make a map of the school compound including the garden. What foods can we buy in the market?

MATH: Measure the class garden. Measure plant growth. How is food measured in the market? How much does food cost? Using money, counting, adding and subtracting. Make a chart to show work done in the garden. Compare sizes of various plants/animals. Cost of tools. Make an inventory of garden tools at school and at home. How long does it take various seeds to germinate? How many brooms did the class make?

ENGLISH LANGUAGE: Vocabulary development: names of plants and animals, names of tools, names of garden activities, names of village workers, plant parts. Describe a visit to a blacksmith, a weaver. Place pictures of seed germination in proper order. Also the steps in broom making. Describe how to go to the market/blacksmith/weaver. Songs, rhymes, finger plays and role play about agricultural activities.

HEALTH: Using brooms to clean the school, home and market. Safe use of tools. Parts of plants we can eat. Plants grow strong with good soil. We grow strong with good food. Plants, animals and people need water. Garden work is good exercise. Benefits of exercise. Plants for medicine. Safe use of medicine. Good food as medicine. Washing hands after work and before eating.

CLASS THREE

TERM I

Topics	Activities
I. What is agriculture? A. Local crops B. Local animals 1. Domestic 2. Bush (wild) C. Farms in our community	Visit local farmers. Make a list of what they grow. Make a map of the village area showing farms. Make a model of a farm you have visited.
II. Tools A. Why we use tools B. Names of tools C. Their uses D. Care of tools	Divide the class into 4 groups, each to dig a hole: one with no tool at all, one with a stick, one with a hoe, and one with a shovel (if available). Compare results. Make a tool chart. Clean tools after use. Interview blacksmith.
III. Soil A. Parts of soil 1. Rocks, sand, clay 2. Leaves, roots 3. Insects, etc. B. Good soil for plants C. Improving soils 1. Composting 2. Tilling	Make settling jars to show soil components. Compare seedlings grown in various soils. Help make a school compost. Do role play to show seeds growing in compacted vs. tilled soils.
IV. Needs of plants A. Water B. Air C. Sunlight D. Soil	Experiment with depriving seedlings of water, air, light or soil. Compare seedlings grown with various amounts of water, air, light, soil.
V. What makes seeds grow A. Soil B. Water C. Temperature D. Seed germination	Role play a growing seed. Finger play about seed growth. Germinate seeds on wet paper. Draw pictures of the germinated seed. Can a seed germinate with no <u>water</u>?
VI. Care of animals A. Good B. Water C. Shelter D. Cleanliness	Invite a guest to describe caring for cattle, pigs, goats, etc. Make a chart to show animal care.

TERM II

Topics	Activities
I. Plant parts A. Roots B. Stems C. Leaves D. Flowers E. Fruits F. Seeds	Describe the purpose of each part, e.g., roots gather nutrients, stems transport nutrients, leaves manufacture food and take air, flowers produce fruits, fruits produce seeds, seeds make new plants. Experiment by pulling all of a plant's leaves, disturbing its roots, breaking the stem, etc. Observe results.
II. Seeds of local plants A. Rice B. Binch (beans) C. Maize D. Okra	Match the seed to its plant. Make pictures of seeds and plants for matching. Compare binch and maize (dicots and monocots).
III. Garden maintenance A. Growing food crops B. What can grow 1. Dry season 2. Rainy season C. Using tools D. Weeds and pests E. Watering F. Composting	Children participate in growing local food crops in a class garden plot. Children should choose what is to be grown (considering season, soil, space, etc.). Each class has its own plot if possible.
IV. Domestic animal care A. Food B. Water C. Shelter D. Cleanliness	Children care for a small animal, e.g., rabbit, guinea pig, etc. Record its growth. Make chart of its care.

TERM III

I. Plant needs A. Water B. Air C. Sunlight D. Soil	Compare the needs of various plants, e.g., cassava needs little water, rice needs a lot. Cover a leaf of a growing plant with black paper to demonstrate what happens with lack of light. Coat a leaf of a growing plant with oil to show what happens without air.
II. Fruits A. Vegetable fruits 1. Garden eggs 2. Tomatoes B. Tree fruits 1. Mango 2. Orange 3. Banana 4. Butter pear (avocado) 5. Oil palm	Observe how flowers produce fruits. Examine seeds in fruits. Identify vegetable fruits and tree fruits in the market. Take a village walk to identify fruit trees. Make charts and drawings. Plant fruit tree on the school compound. Observe palm oil being made.

Topics	Activities
III. Garden maintenance continued from Term II	Sell produce to raise funds for a class project or activity. Reward students with stickers from agricultural projects (ACRE, IADP, Seed Multiplication, etc.). Give a reward for the biggest pile of weeds pulled or insects plucked.

CLASS THREE
RELATED ACTIVITIES

SOCIAL STUDIES: What are different wild animals found in Sierra Leone? Who herds cattle? Make a village map showing farms. Make a classroom model of a farm. What crops grow in rainy season? In dry season? When is rainy season? When is dry season? What tools can a blacksmith make? Where does a blacksmith get his materials? What domestic animals are raised in Sierra Leone? What animals are raised in your community? What would happen if locusts ate all the plant leaves? Has this ever happened in Sierra Leone? Talk to someone in the village who remembers a locust plague. What are the water sources in the village? Show them on the village map. Where can seeds be bought? Children vote on what crops to raise (using democratic processes). What fruits grow in Sierra Leone? In the village? On the school compound? How can money be earned by farming? What would happen if there were no farmers? How is palm oil made?

MATH: Measure the class garden. Keep a growth chart on class crops. Make sets of various seeds. Measure the depth of holes dug with various tools (see Term I tools). Make a chart to record the experiments in Term I needs of plants. Take a village walk and count goats and/or chickens. How many parts does a binch (bean) seed have? A maize seed? How many months in the rainy season? In the dry season? How much can the class charge for its garden produce? How much money is made? Using money and making change. Multiplication in marketing.

ENGLISH LANGUAGE: Write a story (as a class) about a trip to a farm. Describe what happened in an experiment. Role play seed growth. Animal stories, rhymes and finger plays. Describe animals. Keep a garden journal. Tell a story about the class animal. Name things in the garden. Name actions in the garden. Continue vocabulary development. What fruit do you like best. Why? Describe steps in making palm oil.

HEALTH: Farm and garden safety. Water sources. Cleaning a wound. Caring for animals. Good sources of nutrition: foods for bodybuilding, protection and healing, energy. Foods available in dry season and rainy season. What is hungry season? Value of exercise. When do animals sleep? When do we sleep? Benefits of rest. Washing hands after work and before eating.

CLASS FOUR

TERM I

Topics	Activities
I. What is agriculture	Make a chart of local plants. List as many uses as possible for each plant. Visit farms, markets, weavers and carpenters.
A. Uses of plants	
1. For food	
2. Other (shelter, clothing, ornament)	
B. Animals	What animals are raised for food in the village and in Sierra Leone? Visit a work oxen project or invite a guest speaker. How do cats and dogs help us?
1. For food	
2. For labor	
3. As pets and for protection	
II. Tools	What tools are made locally? Visit a blacksmith. Examine animal traction tools if possible.
A. Names and uses	
B. Making of tools	
C. Safe use of tools	
D. Caring for tools	
III. Choosing a garden site	Write a letter to the town chief requesting land. List the qualities of a good garden site. Make a map of the proposed garden showing water source, slope, north, south, east and west, beds and crops.
A. Soil	
B. Slope	
C. Water	
D. Location	
1. Space available	
2. Proximity to school	
E. Security	
IV. Choosing crops	Make a list of all crops that can be grown in the rainy season. Make a list of the nutrients in each crop. What will grow in sandy soils, wet soils, etc.?
A. Good rainy season crops	
B. Nutritional value of crops	
C. Crops and soil	
V. Preparation of land	Have a contest to see who can make the biggest pile of brush. Measure a right angle. Construct parallel lines. Make a compost bin. How can soil be enriched?
A. Brushing and clearing	
B. Measuring and marking beds	
C. Tilling, making beds	
D. Composting and fertilizing	
E. Fencing	
VI. Planting	Nurse tomato seedlings. Compare the growth of seedlings nursed at school and seedlings purchased from another source. Transplant seedlings. Make a chart about planting methods for the crops in the school garden. Test the germination rate of seeds.
A. Nursing and seed beds	
B. Transplanting	
C. Direct planting	
1. Drill	
2. Broadcast	
D. Germination	
VII. Garden maintenance	Record maintenance activities in a garden journal.
A. Watering	
B. Weeding	
C. Controlling pests	

Topics	Activities
VIII. Record keeping A. A garden journal B. Planning and preparation C. Planting/plant growth D. Record of daily activities in the garden/ maintenance E. Harvest and market	Keep a garden journal to record garden plan, daily activities, plant growth, nutritional content of crops, planting methods, results of experiments, stories, poems, drawings.
IX. Parts of a plant A. Roots B. Stems C. Leaves D. Flowers E. Fruits F. Seeds	Study the function of each part. Use colored water to show how a stem transports water. Cover a plant to observe the result of no sunlight. Draw pictures of the flowers of each crop.

TERM II

I. Kinds of crops A. Vegetables B. Cereals and grains C. Trees D. Ornamentals	What vegetables are grown at school? At home? What cereals (or grains) are grown in the area? Around Sierra Leone? What trees are on the school compound? Identify trees on a village walk. Plant an ornamental tree on the school compound. Make an identification chart of ornamental trees.
II. Uses of plant parts A. Food B. Clothing C. Shelter D. Furniture E. Paper F. Medicine	What plants are used for topics A-F? Visit a carpenter. Build a baffa. Make paper. Invite a native herbalist to class. What plant is used to make medicine for malaria? Make malaria medicine. Make lemon grass tea (a good source of Vitamin C).
III. Types of land A. Swamp B. Lowland C. Upland	Draw a map of the village to show swamps, lowlands and uplands. Make a scale model of the village area.
IV. Seasonal changes and garden maintenance A. Rainy season 1. Erosion control 2. Leaching B. Dry season 1. Conserving water 2. Protection from sun C. Mulching	What is erosion? Make a splash board to study splash erosion. Do an experiment to show how capillary water moves through soil leaching nutrients. How can soil hold water in the dry season? Experiment with mulching beds to hold water. Build small baffas to protect tender plants from the sun (e.g., lettuce).

Topics	Activities
V. Needs of plants A. Water B. Air C. Soil D. Light E. Protection 1. Sun 2. Wind 3. Rain 4. Pests	Conduct experiments to see the influence of water, air, soil and light on plants; e.g., grow seedlings in topsoil, eroded soil and subsoil. Can a plant survive with no soil, water, light or air? Oil a plant's leaves to prevent it from getting air. What happens? Build a fence around the garden. Build a shelter for tender plants. Discuss biological, cultural and mechanical pest control.
VI. Functions of plant parts A. Roots: anchorage, absorption B. Stems: transportation C. Leaves: photosynthesis D. Flowers: reproduction E. Fruits: reproduction F. Seeds: reproduction	Compare the root systems of various plants. Why do larger plants have deeper root systems? How does a plant get water and nutrients from the soil? Why do plants wilt? Test a leaf with iodine for starch content. Examine the parts of a flower. Draw pictures of a tomato flower, fruit and seed.
VII. Ways to grow plants A. From seed B. From suckers C. From vines D. From cuttings	Make a charge to show local plants grown from A-D. Plant something from each source, e.g., tomato, pineapple, potato vine, cassava sticks.
VIII. Harvesting A. Vegetables B. Leaves C. Root crops	What crops continue producing as you harvest? e.g., garden eggs, cassava and potato leaf. What plants must be pulled from the ground to harvest? *Potatoes, cassava, groundnuts.*
IX. Useful ornamentals A. Lemon grass B. Kumbajaro (datura) C. Coco yams (taro) D. Hibiscus E. Sanservera (mothers-in-law tongue)	Identify ornamentals on the school compound. Gather lemon grass and make tea. Why do people plant kumbajaro around their houses? The large leaves of the coco yam are attractive and the root is edible. The hibiscus flower makes a Vitamin C-rich tea. The flower can make litmus paper to test acids and bases. Sansevera makes a soft fiber used to make bags.

TERM III

Topics	Activities
I. Planting A. Nursing and seed beds B. Companion planting C. Types of beds 1. Raised beds 2. Flat beds 3. Ridges and mounds 4. Sunken	Nurse peppers and garden eggs. Let children take some of the seedlings to their families. Plant corn and groundnuts together. Study the nitrogen cycle. Control insects by companion planting; for example, pumpkin helps protect corn.
II. Soil A. What makes soil 1. Sand 2. Clay 3. Leaves and roots (humus) 5. Insects B. Air in soil C. Water in soil D. Earthworms E. Kinds of soil 1. Clay 2. Sand 3. Silt or loam	Make "soil" by rubbing stones together. Examine soil samples in settling jars to see their components. Dig soil from an undisturbed wooded area. Look for animal life such as worms, grubs, snails, spiders, insects, etc. Pour water in a jar of water. Observe the bubbles. This is the air in the soil. Put soil in jars and place them in the sun. The water in the soil will condense on the jar. Examine samples of clay, sand and loam soils. Record the characteristics of each. Make an earthworm farm. Observe the effects of earthworms in a soil sample.
III. Which crops for what soils A. Swamp B. Lowland C. Upland	On a village map showing swamps, uplands and lowlands, indicate what crops are grown there. Collect soil samples from those areas. Compare them using settling jars.
IV. Root types A. Tap B. Fibrous C. Aerial	Grow plants in glass jars to show root systems or pull growing plants to observe roots. Make drawings of the 3 root systems and list plants with each type of root.
V. Leaf types A. Simple B. Compound Veination	Collect leaves and arrange them into categories of leaf type. Do leaf rubbings. Observe dry leaves whose vein systems remain.
VI. Uses of plant parts A. Fiber 1. Raffia 2. Piassava 3. Vowei or gbunkurh (entada pursactha) 4. Oil palm fibers B. Oil 1. Palm oil 2. Nut oil	Display various items made from plant fibers and identify the plants. Make crafts from various fibers. Observe palm and nut oil production.

Topics	Activities
VII. Local and national crops A. Garden B. Farm C. Plantation D. Crops for export	Make a chart to show crops of Sierra Leone and the districts in which they are grown. Also chart which crops are exported.
VIII. Uses for land A. Farming B. Housing C. Roads D. Fishing and hunting E. Conservation	On the class map of the village, identify the uses of land. What would happen if all the bush were cleared? How much forest is left in Sierra Leone? How do we depend on the land? Make a terrarium to show a balanced environment.
IX. Seed preservation and storage A. Rice B. Maize C. Okra	Children collect and process the seeds from rice, maize, and okra. Store samples of each in an open container, a bag, and a sealed container. After a few months, test and compare germination rates.
X. Farm safety A. Fire and burns B. Mending wounds	Invite a dispenser or nurse to discuss how to care for a burn or wound. Demonstrate washing and bandaging a wound.
XI. Caring for animals A. Food B. Water C. Shelter D. Cleanliness	Compare the basic needs of people and animals. If possible, care for a classroom animal such as a guinea pig or rabbit. Draw pictures to illustrate its care. Record its growth. How do we care for animals at home?
XII. Garden maintenance A. Watering B. Weeding and pest control C. Mulching D. Composting E. Caring for tools	Continue tending a class garden plot. Mulch beds as in Term II. Compare weed growth in beds with and without mulch. Compare growth of plants with and without compost. Keep an inventory of tools and a record of their care.

CLASS FOUR
RELATED ACTIVITIES

SOCIAL STUDIES: What jobs depend on plants and plant products? Make a collection of items made from parts of plants. Find out about local traditions regarding upland and lowland farming. What other areas of the world grow rice? Maize? Who provides health care in the village? The chiefdom? The district? What are the origins of various domestic animals? What organizations deal with conservation? What are imports and exports? List examples of each. List examples of imported tools.

MATH: Measure slope in various areas of the school compound. Measure rainfall. Compute the number of bush sticks needed to fence the school garden. Measure the perimeter and area of the garden. Determine the percentage of germination of various seeds. Measure plant growth. Predict crop yield. Make a graph to show predicted yield and actual harvest. Make change for market purchases. Measure rice, groundnuts and palm oil.

ENGLISH LANGUAGE: Record experiments and gardening activities in a garden journal. Write interviews with farmers, artisans and health workers. Learn new vocabulary associated with agriculture. Describe the process of using a fiber to make a bag, broom or in building. Write letters to invite visitors to the class. Learn the names of ornamental plants in English and the local language.

HEALTH: Nutritional content of garden crops. Caring for burns and wounds. Compare the basic needs of plants, animals and people. Make lemon grass and hibiscus tea to illustrate the value of Vitamin C in tending a fresh cold. Learn the uses of various nutrients: proteins, carbohydrates, vitamins and minerals. Where can these each be found? What health workers are in the village, chiefdom and district? What plant products can be used as medicines? What causes malaria? Make native malaria medicine.

CLASS FIVE

TERM I

Topics	Activities
I. Agriculture and its importance A. Hunting and gathering societies B. Domestication of plants 1. Hoe agriculture 2. Plow agriculture C. Types of crops 1. Vegetable 2. Grain (rice, millet, etc.) 3. Plantation D. Uses of domesticated plants 1. Food 2. Fiber 3. Medicine 4. Oil 5. Forage 6. Ground cover a. Erosion control b. Nutrient fixing	List examples of foods still gathered from the bush. Is Sierra Leone primarily a hoe or plow agricultural society? List advantages and disadvantages of each. Make charts demonstrating types of crops. Visit farms growing each kind of crop. Compare the planting and maintenance techniques for each type of crop. What plants can be used in more than one way (e.g., oil palm for oil and fiber)? Invite a herbalist to speak to the class. What do domestic animals eat? Make a bag or mat from a fiber plant. Compare the topsoil in areas with and without ground cover. Make an erosion model to demonstrate benefits of ground cover in controlling erosion. What crops fix nutrients? What is green manure?
E. Crops and the local economy 1. Staple crops 2. Plantation crops 3. Vegetables for the market 4. Kitchen gardens	Compare the staple crops of various countries (e.g., rice in Sierra Leone, millet in Senegal, wheat in America). Where do the vegetables in the market come from? Ask some market women to find out. What is growing in the kitchen garden of each pupil?
II. Soil A. Components of soil 1. Rock and sand 2. Organic matter a. Plants b. Insects and other life 3. Water 4. Air	Use settling jars to analyze soil components. Examine soil samples for organic life. Make an earthworm farm. Do an experiment to demonstrate how water moves through soil. Compare the amount of water various soils will hold. Do experiments to demonstrate air and water in soil.
B. Soil types 1. Sand 2. Loam 3. Clay	Compare the qualities of samples of sand, loam and clay soils. Make litmus paper from hibiscus flowers to test soil Ph.
C. Soils and crops 1. Crops for acid soils 2. Crops for alkaline soils 3. Upland crops 4. Lowland crops	How can the Ph of soil be changed? Experiment with limestone and potash to change soil Ph. What crops grow in acid soils/alkaline soils? What crops are grown in uplands/lowlands? Compare the cultivation of upland and lowland rice?

Topics	Activities
III. Improving soil fertility A. Chemical fertilizers 1. Major nutrients a. N-nitrogen b. P-phosphorus c. K-potassium 2. Application B. Organic fertilizer 1. Sources of N, P and K 2. Composting 3. Mulching	What are the signs of nitrogen, phosphorus or potassium deficiency? Conduct experiments in the class garden to demonstrate the effects of nutrient deficiency. Demonstrate proper application of chemical fertilizers. Build a compost bin or pit. Work compost into beds in the school garden. Mulch beds to control insects, evaporation and erosion. Compare the growth of plants with chemical fertilizers, with compost and with nothing. Compare growth of mulched and unmulched plants.
IV. Tools A. Evolution of tools 1. Bone 2. Stone 3. Iron B. Agricultural tools 1. Hand tools 2. Animal traction tools 3. Mechanized tools C. Care of tools 1. Maintenance 2. Safety	What tools are used by local farmers? By agricultural projects in the area? What tools can the class improvise from bone and stone (e.g., digging tools, scrappers, grinders, hammers)? Visit an oxen plow project or invite a speaker to class. What are the advantages of mechanized tools (e.g., cost, petrol, efficiency)? Clean tools after each use by washing and then wiping with a small bit of kerosene. How does kerosene protect the tools? Demonstrate and practice safe use of tools in the school garden.
V. Nursing seedlings A. Purpose of nursing seedlings 1. Controlled conditions a. Water b. Sun 2. Attention 3. Richer soil B. Seed beds and boxes C. Transplanting	Build seed boxes. Nurse tomato, garden egg and pepper plants for the school garden. Compare the growth of nursed plants with plants directly planted. Demonstrate and practice transplanting seedlings.
VI. Planting A. Transplanting B. Direct 1. Broadcast 2. Drill C. Cuttings D. Preparing beds 1. Choosing type of bed a. Raised b. Flat c. Ridges and mounds d. Sunken	Compare the yield of crops planted by various methods. What crops are grown by each method? Plant examples of each in the school garden. Which beds are appropriate for which crops? Use examples of each bed in the school garden.

Topics	Activities
VI. Planting (continued) 2. Constructing beds a. Raised b. Flat c. Ridges and mounds d. Sunken	
VII. Garden maintenance A. Water 1. When to water 2. How much to water	Calculate the water needs of the school garden. What are the water needs of various local crops? What crops are drought resistant?
B. Weeding 1. Identifying weeds 2. Hand cultivating 3. Mulching	Distinguish between seedlings and weeds. How do weeds interfere with crop growth? Use hand cultivation for weed control (also to control evaporation and erosion). Compete to see which student can collect the most weeds.
C. Pest control 1. Identifying pests 2. Organic controls 3. Chemical controls	Which insects are harmful to the garden? Which are beneficial? Make charts of insects for the classroom and collect samples of each.

TERM II

I. Seasons A. Rainy season 1. Crops 2. Nutrient leaching 3. Water erosion 4. Water table B. Dry season 1. Crops 2. Wind erosion	Make charts showing which crops are appropriate to each season. If some can be grown in both seasons, but with different cultivation methods, list the methods. Do an experiment to demonstrate leaching. Make a model to demonstrate water table. How can wind erosion be controlled.
II. Parts of a plant A. Roots 1. Types a. Fibrous b. Tap c. Aerial 2. Functions a. Anchorage b. Transportation	List plants with various root types and examine examples of each. What happens when a plant is uprooted? Why? How does a plant get water and nutrients from the soil? Place a young uprooted bean plant in colored water and observe its stem.
B. Stems 1. Support 2. Transportation	What happens to a plant when its stem is broken? Compare a plant's stem to the human spine (backbone).

Topics	Activities
II. Parts of a plant (continued) C. Leaves 1. Types a. Simple b. Compound 2. Functions a. Transpiration b. Photosynthesis D. Flowers, fruits and seeds 1. Flowers a. Structure b. Pollination 2. Fruits 3. Seeds a. Types and structure b. How seeds travel c. Germination	Examine examples of simple and compound leaves (e.g., tomato and cassava). Coat a leaf with vaseline and observe what happens. Enclose a plant in a clear plastic bag. Where does the moisture in the bag come from? What happens to a plant that does not get sunlight? Do a photosynthesis experiment. Dissect a flower and identify its parts. Make a chart to illustrate pollination. Cut open fruits and vegetables to find their seeds. Examine various seeds. How do seeds travel (wind, birds, etc.)? Wrap bean seeds in moist newspaper. Examine them as they sprout.
III. Seed preservation A. Protection from moisture B. Protection from light C. Judging viability D. Testing germination	A seed is a living thing requiring certain circumstances to thrive. Parch rice and wrap it in small scraps of cloth as a dessicant for stored seeds. Demonstrate storing seeds in jars whose lids are sealed with vaseline. Conduct seed germination tests and predict the germination rate of various batches of seed.
IV. Land management A. Conservation B. Erosion control C. Crop rotation D. Fallow land E. Improving fertility F. Contour plowing G. Slash and burn agriculture	What is conservation? Why practice it? How can erosion be controlled? Observe area where sheet, rill and gully erosion have occurred. How can rotating crops enrich the land? Ask local farmers about how they rotate crops or allow land to lay fallow. Where can contour plowing be practiced in Sierra Leone? What are the advantages and disadvantages of traditional slash and burn agriculture?
V. Local cash crops A. Cocoa B. Coffee C. Palm kernels D. Kola E. Rice F. Piassava	Examine examples of local cash crops. What are cash crops of Sierra Leone? What are the advantages/disadvantages of cash crops?

TERM III

Topics	Activities
I. Harvesting and storing A. Managing the harvest 1. To eat 2. To sell 3. To replant B. Storing 1. Hygiene 2. Containers	Ask local farmers how much of their crops they eat, sell, and keep for seed. Where do local farmers get seed rice? Would it be more or less economical if they grew their own? What pests disturb stored crops? Build stick pallets to demonstrate how rice may be stored off the floor or ground.
II. Preserving and processing A. Drying 1. By heat 2. By sun B. Smoking C. Canning	Which local crops are dried for preservation? Try drying tomatoes. Build a simple solar food dryer. Build a smoker for fish. What imported foods come in cans? How is food canned? Ask a home economist to give a canning demonstration.
III. Marketing A. Setting prices 1. Overhead 2. Profits and losses B. Hygiene C. Local markets D. National and international markets	Make a budget for the school garden. How much must the produce be sold for to make a profit and to raise enough money to continue the garden? Visit the local market. What can be done to ensure that the foods sold are clean? What is available in the village, provincial capitols and Freetown markets? What agricultural products does Sierra Leone get from other countries?
IV. Farm mechanics A. Carpentry B. Agricultural tools	What buildings are necessary on a farm? Build a baffa for the school garden. Build seed boxes. Revise Term I.
V. Animal husbandry A. Local domestic animals B. Classifying animals 1. Grass eating 2. Non-grass eating C. Uses of animals 1. Food 2. Labor 3. Protection	What is a domestic animal? How are local animals used? Classify local animals as grass eating or non-grass eating. How do animals work for us or protect us?
VI. Companion planting A. For nutrient fixing B. For pest control C. For increasing yield and flavor	Plant groundnuts and corn together to ensure a good nitrogen cycle. How do marigolds benefit a garden? Plant peppers and onions together to improve the flavor of each. Plant cucumbers and beans together. Try various experiments to see which plants grow well together. What are local companion planting practices?

CLASS FIVE
RELATED ACTIVITIES

SOCIAL STUDIES: Study hunting and gathering societies such as the Kung of the Kalahari Desert. How did plants and animals become domesticated? How does women's agricultural role change when plow agriculture develops in a country? What is subsistence agriculture? What are the staple crops of West Africa? Of Europe? Of America? How are agricultural products marketed? What is the Green Revolution in Sierra Leone? What happens to the economy of a country when its soil is depleted? What are local cultural beliefs about upland and lowland farming? Study the evolution of tools. What role do tools play in our lives? What agencies and projects in Sierra Leone do agricultural and conservation work? What are the seasons of Sierra Leone? Of West Africa? What are the advantages and disadvantages of cash crops? How are crops transported to market? What is the importance of the farmer in a nation's economy? How are prices set for agricultural products?

MATH: Record the Ph of garden soil on a scale of 0-14. What is the N-P-K ratio in various fertilizers? Measure the bush poles cut to build a garden baffa. Measure the area and perimeter of garden beds. Calculate the water needs of a garden. Predict seed germination rates. Measure the slope of a garden plot. How many seeds are needed to plant a garden bed? Measure materials used to build a seed box or rice pallet. Graph the results of various experiments in the school garden. Predict garden yield and graph a comparison of predicted yield to actual yield. Measure a right angle using the 3-4-5 method.

ENGLISH LANGUAGE: Keep a garden journal, recording all activities in the school garden. Write interviews of farmers, market women, agricultural experts, etc. Write letters requesting assistance in the school garden. List nouns, verbs, adverbs and adjectives associated with the garden. Write poems describing gardening activities. Write stories to describe the growth of a garden vegetable or a day in the life of an agriculturalist.

HEALTH: Study the schistosomiasis (bilharzia) life cycle, prevention and cure. Practice safe tool handling and maintenance. What are calories? Carbohydrates? Plan a balanced diet for a school picnic. What are safe food storage practices? How can hygiene in the market be improved? Study safe water sources. Demonstrate first aid for a cutlass wound. What medicines are made from plants? What is the role of minerals in good nutrition? Which foods protect, build or energize?

CLASS SIX

TERM I

Topics	Activities
I. Uses of plants	
A. Personal	
1. Nutrition	Make a chart of human nutritional requirements and foods that provide those nutrients. What useful things can be made from plant fibers? Make a mat or bag. Compare the processes for making palm nut and groundnut oils. Make medicine for malaria. Plant some ornamental plants around the school compound.
2. Fibers	
3. Oil	
4. Medicine	
5. Ornamental	
B. Economic	
1. Local marketing	Take a class trip to the market. Interview the market women. Where do they get their goods? What foods does Sierra Leone import? Export?
2. Exports	
3. Imports	
C. Types of crops	
1. Arable	Classify local crops as arable, vegetable or perennial.
2. Vegetables	
3. Perennials	
II. Soils	
A. Characteristics of fertile soil	
1. Soil profiles	Examine layers of soil in a road cut. Identify the layers. Invite an expert from a local project or agency to test the soil in the school garden.
2. Testing soils	
B. Soil nutrients and plant growth	
1. N-nitrogen	What are the signs of N, P or K deficiency in plants? Name organic sources of N, P and K.
2. P-phosphorus	
3. K-potassium	
C. Nitrogen cycles	
1. Organic matter	Make a chart of the nitrogen cycle. Plant nitrogen fixing plants. Look at the effects of decomposers under a rotten log.
a. Bacteria and decomposition	
2. Inorganic matter	
D. Alkalinity and acidity	
1. Testing Ph	Make litmus paper from hibiscus blossoms to test soil Ph.
2. Balancing Ph	
E. Soil improvement	
1. Fertilizers	How can acid soils be corrected? Where can chemical fertilizers be obtained?
a. Chemical	
b. Organic	Build a compost bin.
2. Composting	
F. Soil conservation	
1. The making of topsoil	How is topsoil made? How long does it take? How are topsoils lost or depleted? Make a model upland farm in the classroom to demonstrate erosion. Make a plan for rotating corps in the school garden.
2. Effects of erosion	
3. Nutrient depletion	
4. Conservation methods	

Topics	Activities
II. Soils (continued) G. Preparing land for planting 1. Clearing 2. Tilling 3. Double digging 4. Beds a. Flat beds b. Raised beds c. Ridges and mounds d. Sunken beds	Make a chart showing which beds are appropriate for local crops. Make each kind of bed in the school garden. How are lands cleared locally? Visit a work-oxen project or invite a guest speaker. Demonstrate double digging.
III. Water A. How plants use water 1. Nutrient transportation 2. Transpiration 3. Photosynthesis B. Water sources C. Irrigation D. Drainage E. Erosion control	What causes plants to wilt? Demonstrate how stems transport water. Do experiments in transpiration and photosynthesis. How is rice irrigated? Build an irrigation model. How can wetlands be drained? Compare topsoils in areas with and without ground cover.
IV. Land types and their uses A. Uplands B. Lowlands C. Swamps	Make a village map to show location of various land types. What can be grown in each? Visit farms in each of these areas.

TERM II

I. Classifying vegetables A. Leafy vegetables B. Root vegetables C. Fruit vegetables	Make a list of vegetables used in local cooking and classify them as leaf, root or fruit.
II. Seed A. Selecting seed B. Germination tests C. Seed boxes and beds D. Methods of sowing seed 1. Drill 2. Broadcast E. Storing seed	Where can we obtain seeds? Conduct seed germination tests and predict germination rates. Check results by observing germination rates in the school garden. Build seed boxes and beds for pepper and tomato seedlings. Identify which crops should be planted by drill and which by broadcast and plant an example of each.
III. Swamps A. Crop selection B. Preparation and development 1. Drains 2. Plots 3. Bunds C. Maintenance	What is grown in swamps? Visit a developed and an undeveloped swamp and compare the two. Identify drains and bunds. Plant cassava in a swamp and in a dry area. Compare growth. What makes swamp soil fertile? Compare swamp soils to that of other areas. Write a description of a day in the life of a swamp farmer.

Topics	Activities
III. Swamps (continued) D. Advantages 1. Water 2. Fertility 3. Yield E. Disadvantages 1. Labor 2. Diseases	Ask a dispenser or health worker to speak about swamp-related diseases.
IV. National and local plantation crops A. Planning 1. Location 2. Crop choice B. Nursing 1. Reasons 2. Methods	What plantation crops are found in Sierra Leone? In the local community? Describe the steps in developing a plantation. Describe the favorable conditions for each of the nation's plantation crops. Describe the nursing of plantation crops and compare the process to nursing vegetable seedlings.
V. Cash crops for export A. Advantages B. Disadvantages C. Produce marketing boards	Identify the national cash crops. Define cash crop and export. Identify agricultural exports of Sierra Leone. What can exports produce for the country? Find out how cash crop farmers feed their families. What would happen if no one grew food crops? What does the Produce Marketing Board do?
VI. Farm mechanics A. Tools for farming 1. Hand 2. Animal traction 3. Mechanical B. Construction of simple farm materials	Draw charts showing classification of farm tools. List projects using animal traction and heavy machinery. Construct seed boxes, pegs, labels, waterers, etc., from local materials.

TERM III

I. Plantation crops A. Preparing land 1. Brushing and clearing 2. Measuring 3. Preparing stands B. Direct planting 1. Crops planted directly a. Banana b. Ginger c. Pineapple d. Sugar cane 2. Methods of planting	Describe traditional land clearing techniques. What are the disadvantages of slash and burn agriculture? How much land is required for 100 oil palms? How much could 100 oil palms produce? Plant a few examples of direct-planted crops on the school compound. Make charts to show the proper method for planting a-d.

Topics	Activities
I. Plantation crops (continued)	
C. Transplanting 1. Placement 2. Mulching 3. Shading	When is a seedling ready for transplant? How much space is required for an orange tree, oil palm, mango, coffee or cacao? Demonstrate mulching and compare to mulching vegetable crops. Build baffas to shade seedlings.
D. Health of plantation crops 1. Diseases 2. Pests 3. Overcrowding 4. Excess growth	Identify symptoms of common diseases and pests. How can overcrowding be prevented and remedied? What crops must be trimmed? Prune coffee.
E. Reproduction 1. Budding 2. Grafting 3. Seeds 4. Suckers	Observe demonstrations of each method. Practice plant propagation by performing at least two methods. List examples of crops reproduced by each method.
F. Harvesting 1. Record keeping a. Expenditures b. Income c. Yield	When can various plantation crops be harvested? How often? How long from planting to harvesting? What expenditures are involved? What capital investment is required? What are the expected profits? How can profit be predicted? Figure the profit/loss of an actual or imaginary plantation.
2. Distribution of product a. Marketing b. Replantating	How is the produce marketed by an individual farmer? A cooperative? A project? How is stock acquired for replanting and expanding a plantation?
II. Animal husbandry A. Classification of farm animals 1. Ruminants (e.g., sheep, goat, cow) 2. Non-ruminants (e.g., swine, poultry)	Classify local animals as ruminants. Name families that have examples of each.
B. Uses of farm animals 1. Food 2. Labor 3. Compost	Which animals may be used for food, for labor, for both, for their products (e.g., eggs, milk)? Use manure in composts. What manures are most beneficial? Which should not be used?

Topics	Activities
II. Animal husbandry (continued)	
C. Managing an enterprise 1. Choosing a project 2. Selecting stock 3. Constructing shelters	List criteria for choosing an animal project: space, feed, cost of stock, equipment needed, etc. Choose a small class project (rabbits, guinea pigs, poultry, etc.). Gather information from experts guides and manuals, etc. Assign regular tasks to students in maintaining animals. Discuss problems as they arise and make decisions as a class about what action to take.
D. Reproduction	Study the reproductive cycle of the animal the class raises. Observe stages in the cycle.
E. Marketing 1. Age and size 2. Price 3. Expenses and profits	When can the animals be sold as food? As stock? What are the local prices for fowl, beef, bush beef? What price can be expected for the class project? Keep records of expenses and profits.
F. Record keeping 1. Birth/purchase 2. Weaning 3. Mating/birth 4. Medications/inoculations 5. Sale 6. Expenses/profit and loss	Keep a class journal of the animal project, including charts, records and financial accounts. Record daily activities and observations.

CLASS SIX
RELATED ACTIVITIES

SOCIAL STUDIES: What things do we use daily made from plant fibers? Which of these items can be locally produced? Weave a bag, fish net or basket from local fibers. Visit a country cloth weaver. How do goods get to market? Where does the market woman get her produce? What are the imports and exports of Sierra Leone? What is a cash crop? How did domestic animals develop? Compare hand tool agricultural societies to plow agricultural societies. What is the role of the Produce Marketing Board? What are the advantages and disadvantages of cash crops? What measures have been taken in conservation in Sierra Leone? What is the purpose of a nomoli? What are other local cultural beliefs related to agriculture?

MATH: Calculate percentages of seed germination tests. Determine the slope of a field or swamp. Measure the perimeter and area of a garden plot. Determine the amount of seed required to plant a garden plot. Draw a diagram to scale to show where to plant plantation crops with proper spacing between trees. Measure the depth of holes dug to plant plantation crops. Figure expenses, profits or loss on a crop. Chart the rainfall throughout the school year. Chart the growth of the animals kept by the class.

ENGLISH LANGUAGE: Describe the process of making a local craft from plant fibers. Make a list of questions to ask in an interview of a farmer, market woman or an agriculturalist. Write an interview based on the answers to the class questions. Maintain a garden journal to record and describe all activities in the class garden. In the garden journal keep a glossary of gardening terms. Write letters to request agricultural information, arrange field trips or to invite guest speakers. Describe a day in the life of a market woman or farmer. Write a story about the class' animals. Read local animal fables. Read the description of a harvest in Camara Laye's *The African Child* and compare it to local practices.

HEALTH: What foods comprise a balanced diet? What nutritionally related diseases are common to Sierra Leone? What is the function of each of the vitamins and in what local foods are the vitamins found? What is schistosomiasis (bilharzia) and how can it be prevented and cured? What causes malaria? Describe its prevention and cure. Learn to care for a boil or tropical ulcer. What are safe water sources? How is water important to health? Learn to make an oral rehydration drink. What sources of protein come from animals? What basic needs do animals and people have in common? Study human reproduction by observing animals.

ABOUT TEACHING IN THE WHOLE GARDEN

THE WHOLE CHILD

When a child is sent on an errand to the market it is the whole child who goes. Fingers, toes, belly, nose, intellect and emotions—the whole child goes to the market. Think of all the skills the child needs to accomplish the task: physical coordination and strength; the language skills to communicate; the math skills for counting items and money; the interpersonal skills for bargaining and greeting people; the ability to set goals and stick to a task; some minimal reading skills, and a host of other skills and accomplishments. Any task that a child attempts involves a similar integration of skills.

Curriculum design in the schools should recognize that education addresses the whole child as well. There is not a math child, a reading child or a science child, but rather one person absorbing all the subject areas into one brain which attempts to organize the input into some meaningful pattern.

AN INTEGRATED CURRICULUM

This gardening curriculum offers suggestions for integrating science, math, social studies, English language and health instruction while developing a school garden. Integrating curriculum while teaching practical skills assists the child in organizing the material learned in basic academic subjects into meaningful (and useful) patterns.

LEARNING BY DOING

Children learn best by doing. Doing requires motivation, curiosity, some freedom to experiment and explore, and an opportunity to put basic skills to practical application. This approach to learning is called by various names, including discovery learning and experiential education. Whatever it may be called, learning by doing involves the whole child. Learning activities structured to allow the child to discover answers through exploration and experiment call upon all of the child's resources and give practical meaning to education.

THE ENVIRONMENT AS A TEACHING TOOL

This approach to teaching may seem difficult to the teacher. It requires a different kind of planning and organization than that required in traditional classroom teaching where the teacher stands and talks while the children sit and listen. It may seem even more difficult where there is a great scarcity of materials and resources.

Giving children opportunities to learn by doing does require that children have hands-on experience, but *does not* mean that scarce and expensive equipment is essential. Quite the opposite. What is the use of teaching children with equipment that they may never encounter in their homes or community? A much more valuable experience would be the opportunity to explore and discover the actual environment around them. The richest teaching tool available to schools is the natural environment. A school garden can be a laboratory for teaching the entire primary school curriculum.

IMPORTANCE OF AGRICULTURAL EDUCATION

What is the purpose of education? If we agree that it is to assist children in developing the skills they need to live productive lives, we must look at what those skills actually are. In an agricultural society, a child probably gains a great deal of agricultural experience outside the school. A deeper understanding gained through discovery learning in school gives the child a greater opportunity to make a positive and progressive contribution to agricultural activities for his or her family and community. Unfortunately, there is sometimes a negative attitude toward agricultural instruction in the schools.

Freetown Teachers College lists the following problems in attitude towards primary school agriculture:

- Farming is for illiterates.
- School gardening is labor demanding.
- There is a shortage of resources and materials.
- Land is not always available.
- Starting a garden may be expensive.
- There is no money for farm assistance. All of the work must be done by pupils and students.

- Tools may not be available.
- There may not be an adequate water source.
- There is not an agriculture syllabus.
- There may be debate over how to share the proceeds.

While some of the limitations listed pose real problems, the negative attitude towards agricultural activities is inappropriate, especially in an agricultural society. After all, the farmer is the one who feeds us all! An appreciation for the role of agriculture, and an enthusiasm for agricultural activities can be fostered in the schools. The development of positive attitudes depends largely on the teacher's management and planning.

PLANNING AND DISCIPLINE

In discovery learning, children are encouraged to ask questions and to find their own answers. The children need freedom to move about, to discuss and to make mistakes as they search for the answers to their questions. This bustle and activity may be uncomfortable at first for teachers who feel a need for stricter control and conformity. It may take some time on the teacher's part to see that an involved child is a disciplined child no matter how much movement and noise may be involved.

If the lessons are well planned, the students will be on task. One way of ensuring that all of the students are involved in an activity is to divide the class into small groups and to assign a task to each group. The teacher can experiment with the amount of student freedom he or she feels comfortable with. As children gain experience with the discovery approach to learning, the teacher will find that the children are disciplined by their own desire to learn.

Too often labor in the school garden is used as a punishment. If the school garden is to be a constructive learning tool, the teacher must be careful to use gardening as a positive experience. Requiring students to do gardening tasks as a punishment is self-defeating. The teacher must work toward developing positive attitudes towards agricultural work, avoiding any negative or punitive associations with the work. As students become involved in the active learning the garden offers, a better punishment would be to *exclude* children from the garden work.

DEVELOPING COOPERATION AND LEADERSHIP

Learning activities in the school garden can be structured to develop cooperative effort and group problem solving. Experiments should be done in small groups. Perhaps each group can do a part of an experiment so that each group contributes to the larger task. The teacher can experiment to find ways of organizing activities so that each child is involved and each effort contributes to the task at hand. Through these activities students can acquire a sense of individual accomplishment as they each develop the skills necessary to the success of the class project.

These qualities of cooperation and leadership will carry over into the child's life in school and the community.

PLANNING A SCHOOL GARDEN

The steps involved in initiating a school gardening program will vary from school to school, but more generalizations can be made. Here are some suggested guidelines:

1. STAFF PLANNING: A faculty meeting of all of the teachers who wish to participate in the garden can be called by the headmaster or any interested teacher. A list should be drawn up of all the steps necessary in beginning the garden. Points to consider include acquiring land, seed and tools, providing water and security, allotting garden space to each class involved, informing parents and community leaders, working the garden into the timetable, integrating curriculum, requesting assistance from projects and agriculturalists, etc.

2. COMMUNITY LEADERS AND CONSULTANTS: A meeting of various community leaders and agricultural experts (farmers, project consultants, etc.) would be useful in developing community support for the garden.

3. PARENT MEETINGS: It is important for parents to recognize the educational aspects of the garden. Parents often have a negative attitude toward gardening at school. They have made sacrifices to send their children to school and need to be assured that academic instruction will not be sacrificed for the garden. It should be carefully explained that the garden is a teaching tool.

4. STUDENTS: The students should be involved in determining the location of garden plots, the crops to be grown, the process of acquiring land, tools and seed, etc. The greater the student involvement in each step of the planning, the greater will be their sense of pride and accomplishment and the more they will learn.

5. PLOTS: Each class should have its own plot even if it means that less can be grown in the garden as a whole. Each class needs its own area in order to build a sense of pride and accomplishment and to have space to conduct experiments that won't be disturbed by other classes. Some schools have assigned individual plots to students when space permits. This seems to work especially well with Classes 5 and 6. An experimental plot within each class plot permits space for controlled experiments while leaving the rest of the class' garden space for production.

A GARDEN JOURNAL

Each class should keep a journal of all of their gardening activities to include:

- Day-to-day account of garden work and observations
- Experiments
- Expenses, profits and losses
- Graphs and charts
- Interviews
- Drawings and diagrams
- Copies of letters to invite speakers, etc.
- Diagram of the garden
- Information about crops, pests, fertilizers, etc.
- Related poems and stories
- Etc.

One way of recording the students' observations and gardening experiences is to write a description as a class. The teacher records the students' responses on the blackboard. A student then transcribes from the blackboard to the garden journal. The journal can be kept in an exercise book, although a larger blank book of some sort is preferable. The purpose of the journal is to pull together all of the information the class studies or gathers about their gardening venture. It can be used to show guests and as a resource manual for other class projects.

DEVELOPING INTEGRATED INSTRUCTIONAL UNITS

It would be useful for the teacher to look through the syllabuses of all subjects for his or her class and list by term any topic that could be taught in the garden. See the syllabus in this curriculum guide for suggestions on related topics. Once the topics for the term are listed, the teacher is well on the way to developing integrated units of instruction for the garden. Since tropical agriculture allows for the planting and harvesting of crops in each of the three terms of the school year, the same basic model of organizing teaching units could be used for each of the three terms, changing only the individual topics. Topics can be adapted to crops which grow in each term. For example, second term is a good time to talk about cassava.

The following is an example of one way of organizing integrated instructional units for the school garden. It is oriented toward Class 5, but can be adapted to all class levels.

TERM ONE

Unit One: Getting Ready to Grow—2 to 3 weeks (Planning the garden)

SUBJECT	TOPICS
Science	Rainy season crops, seed structure, nursing seedlings, seed beds, types of beds, seed germination, composting
Social Studies	Acquiring land, tools and seed, seasons and climate, origins of agriculture, jobs in the community, ecosystems
Math	Measurement, perimeter, calculating germination rates, computing seed need, predicting yield, planning a budget
English Language	Garden journal; write a letter requesting land; nouns: things associated with the garden
Health	Farming for nutrition, nutritional content of crops, healing a tropical ulcer

Unit Two: Begin with the Earth—2 to 3 weeks (Soil preparation)

Science	Soil types, soil components, soil nutrients, erosion and erosion control, organisms in the soil, air and water in soil, food chains
Social Studies	Soil conservation, erosion and famine, origins of tools, soil types in Sierra Leone, interdependency

SUBJECT	TOPICS
Math	Laying out a right angle, determining slope, parallel lines, measuring splash erosion, horizontal-vertical-perpendicular
English Language	Garden journal; writing haiku poetry; verbs: activities related to the garden; write a letter to invite a soil scientist to test the soil in the school garden
Health	Vitamins in nutrition, good food that heals sickness, safe use of tools
Unit Three:	**How Does Your Garden Grow—2 to 3 weeks (Planting, plant biology and maintenance)**
Science	Plant parts and their purposes, fertilizing, photosynthesis, transplanting, leaf veination
Social Studies	Oxygen for planet Earth; hand, plow and mechanized cultivation; sex roles in agriculture
Math	Measuring and graphing germination, growth charts, weight of water, counting plants in a bed by multiplication (3 rows of 6 plants = 18 plants)
English Language	Garden journal; nouns: plants and their parts; interview a local farmer; describe the process of transplanting seedlings
Health	Minerals in nutrition, safe water sources, water and health, oral rehydration therapy
Unit Four:	**Reaping Your Rewards—2 to 3 weeks (Harvesting, preserving and marketing)**
Science	Plant propagation, preserving seed, drying and storing pepper, drying and evaporation
Social Studies	Find out about GTZ's seed multiplication project, how did pepper come to West Africa, visit a village blacksmith, imports and exports
Math	Marketing multiplication, graph predicted yield vs. actual yield, divide proceeds, computing percentages
English Language	Garden journal; verbs: actions related to harvesting processing and marketing; write an interview of a village blacksmith; story writing: The Life and Travels of the Pepper
Health	Foods that protect, build and energize; hygienic food storage; cleaning fruits and vegetables

Terms two and three can use the same four units and the same subjects with topics drawn from term two and three syllabuses.

CONCLUSION

These teaching suggestions are quite general and are intended only as guidelines. The teacher may adapt them to suit his or her own skills, the interest and abilities of the students, and the circumstances in the schools. No curriculum or syllabus is the final word on how instruction must be done. Teaching must be regarded as helping students learn. Where there is no learning, there has been no effective teaching. Teachers must bear this in mind when evaluating the performance of their students. Teaching techniques must be constantly reevaluated on the basis of student accomplishment.

SAMPLE LESSON PLANS

Subject: Social Studies, Science

Topic: Web of Life **Time:** 20 minutes

Objective: The children will demonstrate the interdependence of all living things and the natural environment.

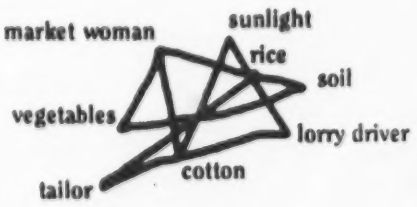
Materials: A ball of string

Previous Knowledge: Students divide into small groups to list the things and people they depend on for survival.

- water
- food
- farmers, market women
- fish, beef, other animals
- fishermen, hunters
- schools, teachers
- health workers
- the government
- petrol, kerosene
- clothing
- tailors
- etc.—consider all responses
- tools
- blacksmiths
- air
- land
- sunlight
- shelter
- carpenters
- fitters
- transport
- trees
- firewood

Procedure:

- Each student chooses a living or non-living thing to represent. Make sure that the basics—air, water, soil and sunshine—are included.
- Sit in a circle.
- Hand the ball of string to one of the basics and ask who in the circle is connected to it in some way.
- Ask the students to briefly explain the connection.



- The first child holds the end of the ball of string and passes the ball to the person with whom they are connected.
- Ask who might be connected to the second child and so on until all the children are connected by passing the string from connection to connection.
- Continue to identify each step in the web.
- **Note:** A child may be connected more than once to ensure that all participants are connected.

Evaluation: The children will be evaluated on the basis of their participation in the activity and discussion.

Subject: Social Studies, Science, P.E.

Topic: Pyramid of Life **Time:** 20 minutes

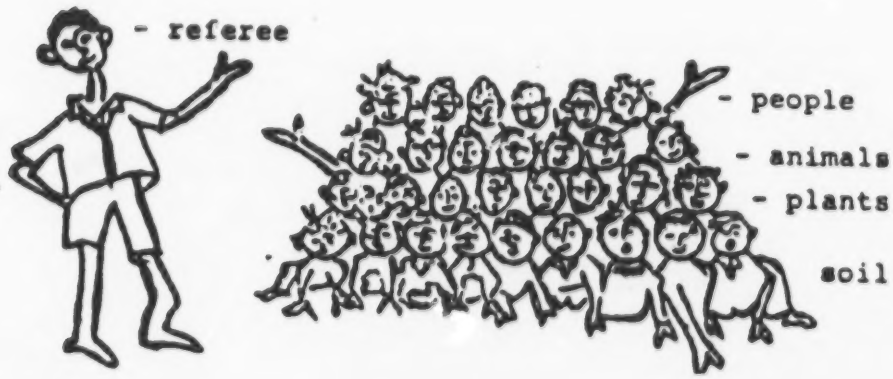
Objective: The children will demonstrate that all living things play a role in maintaining and renewing the natural environment.

Materials: Cut 30 slips of paper. Write soil on 9, plants on 8, animals on 7 and people on 6. If the class numbers more than 30, cut additional slips marked "conservationist." Specific soil types, kinds of plants or animals, or professions may be named.

Previous Knowledge: Students have demonstrated interdependence in the Web of Life exercise, page 37.

Procedure:

- Students draw slips of paper from a bag.
- Go to a cleared area outside.
- Since soil is the base for all life, all soils kneel down down on all fours, shoulder to shoulder, close in a line.
- All the plants line up behind and parallel to soil. Plants line up behind soil, then animals, and finally people.
- The plants climb carefully on top of the soil, also on all fours to make the second step in the pyramid.
- Continue with animals on plants and people on animals.
- What would happen if the soil were weakened or destroyed? The plants? The animals?
- **Note:** The referees assist in safely constructing the pyramid.



Evaluation: Discuss the exercise. Students will be evaluated on the basis of their participation in the exercise and discussion.

Subject: Science, Agriculture

Topic: Making Soil **Time:** 20 minutes

Objective: Students will experience one way soil is formed.

Materials: At least two pieces of limestone or sandstone for each group. If natural stone is not available, pieces of mud or concrete brick may be used. Paper.

Previous Knowledge: Students can identify soil and stone.

Procedure:

- Divide the class into several small groups.
- Distribute sets of stone to each group.
- Instruct students to rub the two pieces of stone together over a piece of paper.
- **Note:** Students should take turns rubbing the stone. It takes time to rub off the particles.

Evaluation: Students write short sentences to record their observations in the garden journal.

Subject: Science, Agriculture

Topic: Soil Components/Settling Jars **Time:** 30 minutes

Objective: Students will identify the components of a soil sample.

Materials: Clear glass container, piece of card or paper, soil sample, water

Previous Knowledge: Students will have collected and compared various soil samples from around the school compound.

Procedure:

- Fill a clear glass container about two-thirds full of water.
- Select a soil sample and pour it into the water until the container is almost full.
- Cover the container with a lid on hand and shake vigorously. Allow the soil to settle, allowing time for the very small particles to settle as well.
- Hold the card or paper against the container and draw a diagram showing the different layers.
- Label each layer (clay, silt, sand, coarse sand, stone).
- **Note:** Vary the exercise by dividing the class into small groups and allowing each group to test a different soil sample. Compare results.

Evaluation: Students will accurately identify the layers of various soil samples and record them in the class garden journal.

Subject: Science, Math, Agriculture

Topic: How Fast Do Soils Take in Water?

Time: Allow 2-3 hours to complete the activity (other activities may be done during waiting time).

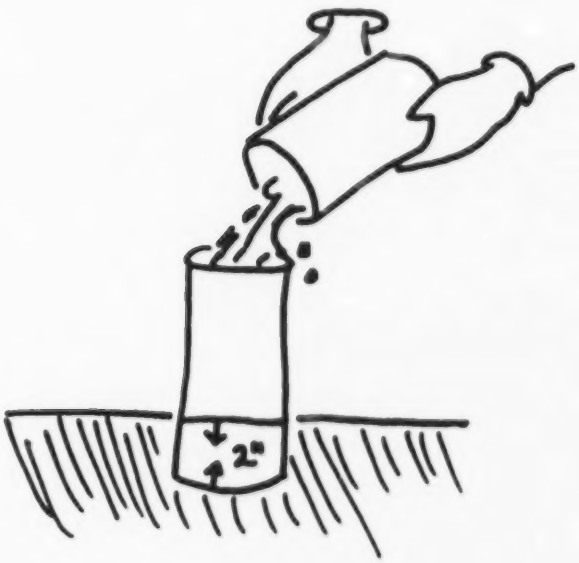
Objective: The children will discover the rate at which various soils absorb water.

Materials: Four large tins of the same size, large stone for hammering, ruler, watch with a second hand, water, pens and paper

Previous Knowledge: Students will have collected soil samples from around the school compound, observing the condition of the soil in each area.

Procedure:

- Cut the top and bottom out of each tin. If possible, remove the rim from the bottom of each tin. (This will make it easier to drive the tin into the ground.)
- Make a mark around each tin two inches from the bottom.
- Select four sites. For example:
  - ✔ An area without vegetation such as the school yard
  - ✔ An area with a light grassy ground cover
  - ✔ A fence line that has never been tilled
  - ✔ The school garden.
- Add water until the tin is full.



- Record the following information on each tin:
  - Location
  - Condition of the soil
  - Presence of leaves or stick
  - Time when water was added
  - Rate at which water is absorbed into the soil.
- Measure with a ruler the amount of water that has moved downward at the end of each minute for the first 10 minutes. Thereafter, note the drop every 10 minutes or every half hour. (Measure from the top of the can to the water level.)
- Compare the rate of absorption in each area.
- What might account for the difference in rates?
- Define porosity.
- **Note:** This activity will work best in four groups, one for each site.

Evaluation: Students will record their findings in the class garden journal.

Subject: Science, Agriculture

Topic: Leaf Transpiration

Time: 20 minutes for each of two days

Objective: The students will observe the water given off from leaves by transpiration.

Materials: Plants in the school garden, clear plastic bags, string

Previous Knowledge: Student will have grown some plants in the school garden. They will know that plants absorb water from the ground through their roots.

Procedure:

- Explain that the class will collect water from a plant.
- Select a large healthy plant in the school garden.
- Tie a clear plastic bag around a branch of the plant. Leave it for 24 hours.
- The following day, carefully remove the bag, taking care not to damage the plant or spill the water in the bag.
- Observe the water collected. Where did it come from?
- Define "transpiration."

Evaluation: The class will record their findings in the class garden journal.

Subject: Science, Social Studies, Agriculture

Topic: The Evolution of Tools **Time:** 45 minutes

Objective: The students will suggest possible uses for various bones, stones and sticks.

Materials: A dozen or more bones, stones and sticks of various shapes and sizes

Previous Knowledge: The students will have used tools in the garden.

Procedure:

- Show the students a bone, stone or stick and ask them to suggest various uses for it.
- List the suggestions on the board. They may include:
  - ✔ To cut something
  - ✔ To hammer
  - ✔ To open a soft drink
  - ✔ To prop open a door
  - ✔ To pull fruit from a tree
  - ✔ As ju-ju
  - ✔ As a pipe
  - ✔ As a paperweight
  - ✔ As a backscratcher
  - ✔ For digging
  - ✔ Etc.
- Explain that long, long ago, people did not have iron tools, but improvised with things from the environment. Gradually, people learned to shape bones, stones and sticks as tools for various purposes. A curved surface could be used as a container. A sharp edge could cut or scrape, etc.
- Divide the class into small groups and give each group a bone, a stone and a stick.
- After about 20 minutes, call the class back together and have each group report on their findings.
- Each group illustrates their item and lists its uses in the class garden journal.
- **Note:** The teacher should move from group to group encouraging the students and giving a few suggestions if needed. Humorous uses for the items are acceptable.

Evaluation: The students will be evaluated on the creativity and originality of their responses.

Subject: Math, Agriculture

Topic: Calculating Seed Need **Time:** 45 minutes

Objective: The students will determine the amount of seed needed to plant a bed in a certain crop.

Materials: List of spacing for garden crops and list of seeds per ounce (page 46), measurements of garden bed to be planted, pens and paper

Previous Knowledge: The students will have chosen which crops they will grow in their class garden. The students know how many inches in a foot, can multiply and divide.

Procedure:

- Choose one crop that has been selected for the class garden (for example, okra).
- Measure the garden bed to be planted and convert the length to inches.
- Determine the number of inches that should be allowed between each plant.
- Decide how much space (1-2 feet) to leave between rows.
- Divide the length of the bed by the space that should be left between each plant. This tells the number of plants per row.
- Divide the width of the bed by the space that should be left between rows. This tells the number of rows.
- Multiply the number of rows by the number of plants per row. This tells the total number of plants per bed.
- Determine the number of seeds to be planted in each hole.
- Multiply the number of seeds per hold by the number of plants in the bed. This will be the total number of seeds needed.
- Refer to the list of seeds per ounce and calculate the weight of the seed needed for the bed.
- **Note:** The teacher should move slowly through all the steps, allowing the students to finish each step before moving to the next. The instructions for each step should be written on the board as each step is introduced. The lesson may be divided into two or three separate lessons, if desired.

Evaluation: The students' work will be evaluated by the accuracy of their calculations.

	Seeds Per Ounce	Spacing Between Plants
Bush Beans	100	4"
Pole Beans	100	6"
Cabbage	8500	14"
Corn	100-200	12"
Cowpea	125	4"
Cucumber	1000	12"
Garden Egg	6000	18"
Lettuce	25,000	12"
Okra	500	12"
Onion	4500	3"
Pepper	4500	16"
Pumpkin	110	15"
Radish	2000	1"
Tomato	11,000	24"
Watermelon	225-300	15"
Groundnuts	50	8"

Subject: Science, Agriculture

Topic: An Earthworm Farm **Time:** 30 minutes

Objective: Students will observe earthworms in order to discover their beneficial effects in the garden.

Materials: Shovel or large blade hoe, garden soil, large glass jar, a little cooked rice or vegetable peelings

Previous Knowledge: Students will have looked for living organisms in the soil.

Procedure:

- Dig down about 12 inches in the school garden where the soil has been well worked.
- Carefully lift out a shovel full of the soil and place it in a flat carton or headpan.
- Gently sift through the soil with bare hands, looking for earthworms.
- Record things that are found in the soil, such as plant roots, ants, slugs, beetles, dead leaves, etc.
- Continue digging soil samples until six or eight earthworms are found.
- Fill a large glass jar with soil. Make sure that the soil is damp but not wet.
- Place the earthworms inside the soil. Be careful not to damage the soft bodies of the worms.
- Keep the jar away from the hot sun.
- Leave the jar alone for a day or so until the worms adjust to their new home. They should be fed by mixing a little cooked rice or minced vegetable peelings into the top inch of soil.
- Eventually the tunnels of the earthworms can be observed through the glass. Does the soil change? What happens to the food? How do the worms move?
- For the students to know: Earthworms help to make the soil rich. They will eat almost anything but are not harmful to plants. When the worm moves through soil it actually eats the soil! The soil comes out of the worm as castings. This helps to make the soil rich in nutrients. When the earthworm moves through the soil it also helps to break up the earth, making it easier for the roots of plants to grow. If you see an earthworm in your garden, do not kill it. An earthworm is a garden's friend.
- **Note:** Can be divided into 3 lessons.

Evaluation: Students record their observations in the garden journal. They can also draw diagrams of the earthworm.

Subject: Health, Agriculture

Topic: Growing Crops For Their Nutrients **Time:** 45 minutes

Objective: The class will select crops for their garden based on the nutritional content of each crop.

Materials: Charts of nutritional content of local garden crops and daily nutritional requirements, chalk, chalkboard

Previous Knowledge: The students will know the role of calories, protein, vitamins and minerals in nutrition. They will also know what crops will grow in the area.

Procedure:

- List crops on the chalkboard that will grow in the area during the current season.
- Use the chart on page 49 to determine the nutritional content of each crop.
- Refer to the chart below on nutritional requirements for children ages 8-10.
- Which crops would help meet those requirements?
- Plan a meal that meets the requirements.
- Now, choose crops for the garden whose harvest would produce a balanced meal.
- **Note:** The two following charts may be used for a wide variety of lessons.

Evaluation: The students will record their results in the garden journal and will choose crops based on their findings.

	6-8	8-10	10-12 Boys	10-12 Girls
Calories	2,000	2,200	2,500	2,250
Protein	35 gm	40 gm	45 gm	50 gm
Vitamin A	3500 IU	3500 IU	4500 IU	4500 IU
Vitamin C	40 mg	40 mg	40 mg	50 mg
Niacin	13 mg	15 mg	17 mg	16 mg
Riboflavin	1.1 mg	1.2 mg	1.3 mg	1.4 mg
Thiamin	1.0 mg	1.1 mg	1.3 mb	1.2 mg
Iron	10 mg	10 mg	10 mg	18 mg
Calcium	0.9 gm	1.0 gm	1.2 gm	1.3 gm

NUTRITIONAL CONTENT OF LOCAL CROPS

	Protein	Vitamin A	Vitamin C	Niacin	Riboflavin	Thiamin	Iron	Calcium	Calories
Broad Beans	H	P	P	M	M	M	H	M	H
Cow Peas	H	P	P	M	P	M	H	M	H
Cabbage	P	H	H	P	P	P	P	M	P
Corn	M	H	M	M	M	H	P	P	M
Cassava Root	P	P	P	P	P	P	P	P	H
Cassava Leaf	P	H	M	P	P	P	P	M	P
Cucumber	P	P	H	P	P	P	P	P	P
Garden Egg	P	P	P	P	P	P	P	P	P
Lettuce	M	H	H	P	M	P	M	P	P
Okra	P	H	M	P	P	P	P	H	P
Onion	P	M	P	P	P	P	P	P	P
Pepper	P	P	M	M	P	P	P	P	P
Pumpkin	P	H	M	P	P	P	P	P	P
Tomato	P	H	H	P	P	P	P	P	P
Watermelon	P	P	P	P	P	P	P	P	P
Rice	P	P	P	P	P	M	P	P	H
Sweet Potato	P	M	M	P	P	P	P	P	H
Potato Leaf	P	H	H	P	P	P	M	P	P
Groundnuts	H	P	P	H	P	P	M	M	H

Subject: Science, Art, Agriculture

Topic: Leaf Structures **Time:** 45 minutes

Objective: The students will examine a variety of leaf shapes in the natural environment.

Materials: Garden journal pages, cellotape (or cassava paste), list of leaves, chalk, chalkboard

Previous Knowledge: The students can identify the parts of a plant.

Procedure:

- The teacher explains to the students that they will be going around the school compound searching for leaves that match the following descriptions (listed on blackboard):
  - Leaf that is wider at the top than at the bottom
  - Leaf with smooth edge
  - Leaf that is wider at the bottom than at the top
  - Leaf with a toothed edge
  - Leaf that is not entirely green
  - Leaf with veins that are parallel to one another
  - Leaf made up of leaflets
  - Round leaf
  - Leaf that tapers at both ends
  - Rough-textured leaf
  - Smooth-textured leaf.
- Divide students into groups. Allow 20 minutes for the groups to find examples of as many different types of leaves as possible.
- Reconvene the class and ask each group to present their leaves to the class.
- Mount them on paper in the garden journal using cellotape (or cassava paste).
- Identify as many as possible. It is fine to use local names for the plants if the English name is not known. Also identify where the leaf was found.

Evaluation: Students will be evaluated on the basis of their participation.

Subject: English Language, Agriculture

Topic: Verbs: Activities in the Garden **Time:** 30 minutes

Objective: The students will identify as verbs actions involved in gardening.

Materials: The garden

Previous Knowledge: The students know that verbs are words that express action or being.

Procedure:

- While working in the garden, the teacher asks a student what he or she is doing.
- Isatu answers, "I am weeding."
- The teacher instructs Isatu to ask another student what he or she is doing.
- Abu answers, "I am hoeing."
- The questions continue until everyone has had a turn.
- The teacher asks the students what a verb is.
- Then the teacher asks each student (in turn) to demonstrate a verb silently.
- The other students identify the action. For example: Alhaji is digging. Hawa waters the tomatoes. John brushes the weeds. Kadi picks garden eggs.
- Note: The same language experience activities may be done for nouns, prepositions, adjectives and adverbs.

Evaluation: The students are evaluated on the basis of their participation and response.

Subject: Health, Music

Topic: Oral Rehydration Therapy

Time: 45 minutes. To be done just after returning to class following garden work.

Materials: A pit bottle, a bottle stopper, small amount of sugar and salt, water

Previous Knowledge: Students will have studied the importance of clean water to good health.

Procedure:

- When the students return to class following garden work, the teacher asks, "Is any one thirsty?"
- Most of the class will be thirsty. (Clean drinking water should always be available in the school.)
- The teacher asks, "Why are you so thirsty? Has your body lost water?"
- The teacher leads the students to conclude that they have lost water through perspiration (sweat).
- What happens to the body when you vomit or have runny belly?
- Discuss how body water is lost in these ways.
- A quick way to replace water in the body is a drink made from salt, sugar and water.
- Teacher demonstrates mixing the oral rehydration formula:
  One pint water
  One stopper sugar
  One pinch salt
- This drink should be given with each frequent stool or each time someone vomits.
- What happens to the body when too much water is lost?
- Students practice mixing the rehydration drink. Everyone should have a chance to test it.
- **Note:** An easy way to teach this formula is to learn a song about it. Many such songs have been written in Sierra Leone, many in the local languages. Here is one used by the teachers in Makali, Tonkolili District.
- **Note:** There should be a poster of the formula in the classroom. Frequent reference should be made to it.

Evaluation: The students will be evaluated on the basis of their ability to mix the formula.

The Runny Belly Song

Oh mama oh mama oh
Oh mama oh mama oh
Di pekin e vomit
Oh mama oh
E git runny belly
O mama oh
Wetin yu du?
O mama oh

Yu git for du sumtin
Oh mama oh
Tek clean wata put am pan di cup
Mix am all up

Oh mama oh mama oh
Oh mama oh mama oh
Di pekin drink plenti
Oh mama oh
Di pekin don gladi
Oh mama oh
Oh mama oh mama oh
Oh mama oh mama oh

Subject: English Language, Social Studies, Agriculture

Topic: Writing an Interview: A Day in the Life

Time: Three lessons
1. Choosing questions—45 minutes
2. Conducting an interview—30 minutes
3. Writing an interview—45 minutes

Objective: The students will interview a local person engaged in some aspect of agriculture, e.g., a market woman, farmer, tool maker, project consultant, etc.

Materials: Blackboard, chalk, pens, pencils

Previous Knowledge: The students have discussed jobs in the community that serve or depend upon agriculture.

Procedure:

- The teacher asks the class what things they would like to know about a new neighbor or class member.
- The teacher lists the responses of the students on the chalkboard. They might include:
  - What is your name?
  - Where are you from?
  - Why and when did you come here?
  - How many in your family?
  - What work do you do?
  - Etc.
- The students can interview each other, listing the answers to the questions asked on the board.
- The teacher asks the students to suggest someone in the village whose work relates to agriculture whom they would like to interview.
- The class lists questions they would like to ask the person. If the class works in small groups, more than one person can be interviewed.

- The groups invite their guest to school or go to that person's home or work to conduct the interview.
- The students may ask the questions they've chosen for the interview in class. In addition, they may ask questions that arise during the interview itself. For example:
  - "My Farmer, you said you grow rice. What variety do you grow?"
  - "Why do you grow that variety?"
  - "Mrs. Market Woman, you say you sell tomatoes. Where do you get them?'
  - Etc.
- The students write essays about their guest based on the information gathered in the interview.
- The students share their essays with the class.
- Allow time for questions and discussion.
- **Note:** One way to organize an interview is to write about one day in someone's life from waking in the morning until going to bed at night. This may help students to organize the interview questions.

Evaluation: The questions the students ask should be pertinent to agricultural activities. They should reflect an interest in their guest. The essays should reflect an understanding gained by the student. Record the essays in the class journal.

Subject: Science, Math, Agriculture

Topic: Germination Test/Computing Germination Rate

Time: 3 lessons
Each: 30 minutes

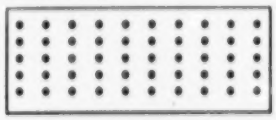
Objective: The students will predict the rate at which the seeds they plant in their garden will germinate.

Materials: Sheets of newspaper or other absorbent paper, 50 seeds of each type to be tested, water, plastic bags, pens and paper

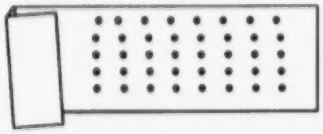
Previous Knowledge: Students will have selected the crops they wish to grow in their garden. They will have studied seed germination. They can multiply fractions.

Procedure:

- To test one type of seed, select 50 seeds of that variety.
- Wet a double sheet of newspaper (or any highly absorbent paper).



- Put the seeds on the paper in rows.
- Fold the paper by row to cover the seeds.



- Put the folded paper in plastic bags and set aside. Large seeds like corn and watermelon will be ready in four days. Smaller seeds take up to seven days.
- After waiting the appropriate time, open the paper and count the seeds which have germinated.
- **Note:** This would be a good time to do a lesson on the parts of a germinating seed.
- To calculate the germination rate, use this formula:

$$\frac{\text{Number of germinated seeds}}{50} \times \frac{100}{1} = \frac{\text{percentage of}}{\text{of germination}}$$

For example:

$$\frac{25}{50} \times \frac{100}{1} = \frac{2500}{50} = 50\%$$

- A germination rate of 60-70% predicts a successful crop.

Evaluation: The students will be evaluated on the basis of their participation and observations, and also on the accuracy of their calculations.

Subject: Science, Agriculture

Topic: The Germinating Seed **Time:** 45 minutes

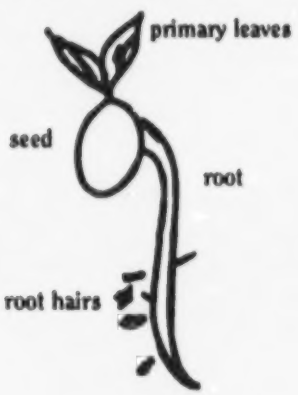
Objective: The students will identify the parts of a germinating seed.

Materials: Seedlings produced in the seed germination test (page 55), chalk, chalkboard, pens and paper

Previous Knowledge: The students will have conducted the seed germination test (page 55). They will know that seeds produce plants.

Procedure:

- The teacher will distribute sprouted seeds to the class, preferably one to every two or three students.
- Allow the students time to examine the seedling.
- The teacher asks, "What is the biggest part of your seedling? How does it look? What is growing out of it?" Etc. The teacher draws each part on the board as the students describe what they have observed.



- The students draw the seed in their exercise books, labeling each part.
- A drawing of the seedling should be entered in the garden journal.
- **Note:** With great care, the seedlings can be planted in a carton of soil. (Line the bottom of the carton with plastic.) Some of the seedlings will survive until they can be transplanted.

Evaluation: The students will be evaluated on the basis of their observations and participation.

Subject: Math, Science, Agriculture

Topic: Measuring the Slope of the Land **Time:** 45 minutes

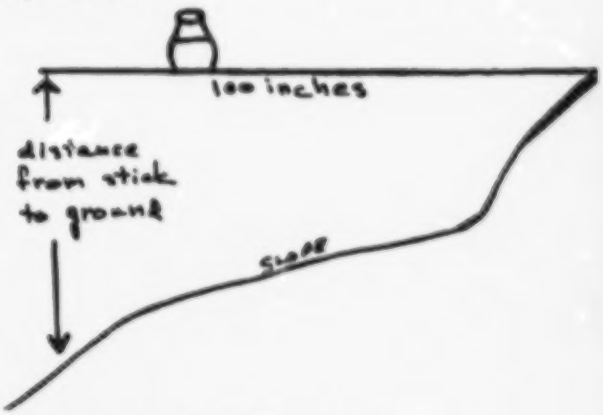
Objective: The students will calculate the percentage of land slope in various points on the school compound.

Materials: A clear glass container half full of water, measuring tape, a straight stick 100 inches long

Previous Knowledge: The students will have explored the school compound gathering soil samples and leaves. The students can measure inches.

Procedure:

- Select a place that has an obvious slope.
- Place one end of a 100-inch stick on the slope you want to measure.
- Hold the stick so it is about level. Place a jar of water on the stick. Raise or lower the stick until the water in the jar is level.
- Measure the distance of the free end of the stick from the ground.
- The number of inches from the free end of the stick to the ground is the percentage of the slope of the land.
- Repeat the exercise in several different areas to get an average slope of the land being investigated.



- Students can work in small groups to measure a variety of sites once the procedure is understood.
- **Note:** Shorter sticks may be used; however, the measurement produced must be multiplied by a conversion factor to yield the correct percentage of a slope:

Stick Length	Distance from Free End to the Ground		Multiply by Conversion Factor		Slope (%)
100 inches	_____ inches	x	_____ inches	=	_____
50 inches	_____ inches	x	_____ inches	=	_____
25 inches	_____ inches	x	_____ inches	=	_____

Evaluation: Students will be evaluated on the basis of the accuracy of their calculations. Results should be identified by the site measured and recorded in the garden journal.

Subject: Science, Practical Arts

Topic: Making a Water-Drop Magnifier **Time:** 45 minutes

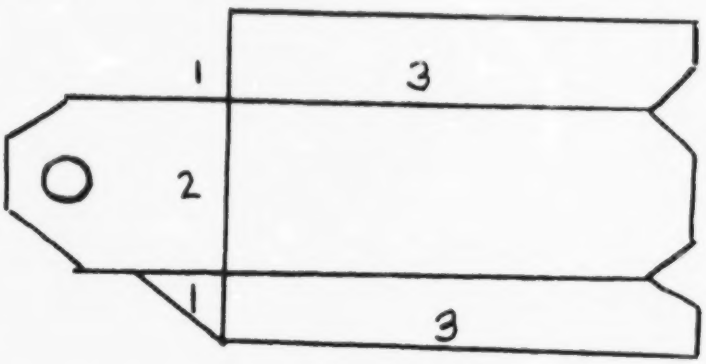
Objective: The students will construct water-drop magnifiers.

Materials: Scissors, lightweight cardboard, pattern, a little petroleum jelly, 2 small match boxes for each magnifier, small string or rubber bands

Previous Knowledge: Students have examined soil samples and know that some things are too small to see with the naked eye.

Procedure:

- Trace the pattern onto light cardboard. (The cover of an exercise book or vanguard is about the right weight.) Cut it out. Cut out the circle.
- Fold down the places marked 1.
- Then fold down the place marked 2.
- Fold in the places marked 3 so that they lie flat.
- The pattern will look like this:



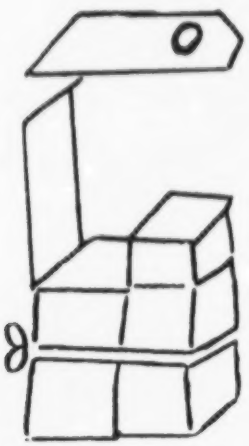
- Tie two matchboxes together with string or a rubber band so that the "drawers" of the boxes are free to slide in and out.
- Push the long end of the folded pattern between the drawer and the back of one matchbox.
- Lightly rub petroleum jelly (Vaseline) around and underneath the cut-out circle. With your finger, clean out any jelly that sticks inside the hole.
- Dip the end of a finger in water. Use your finger to place a drop of water into the cut-out circle. The petroleum jelly will hold the water in place. The water is in the lens of the magnifier.
- Slide up the drawer of one match box. Put something you want to look at on the end of the drawer.

- Look through the water drop. Move the drawer up and down until you can see clearly.
- **Note:** The teacher should experiment with making the water-drop magnifier before presenting it to students. There are a few tricky steps to follow, but once you try it, it's easy.

Things that can be examined with the water-drop magnifier:

- Soil
- Leaves
- Insects
- Seeds
- Roots.

The size of the water drop can be adjusted by touching it gently with a match stick. Experiment!



Evaluation: Students will be evaluated on the basis of their ability to follow directions to produce a finished product.

GLOSSARY

ACID: Soil having a pH of less than 7; acid soils can be improved by adding ground limestone. Acid soil is common in areas with high rainfall.

AERATION: Breaking up soil to provide it with oxygen. Earthworms help to aerate soil.

AERIAL: Roots which grow above ground and feed on air rather than soil.

ALKALINE: Soil with a pH of more than 7; common in arid climates, making soil difficult to till and absorb water.

ANGLE: The measurement of the distance between two intersecting lines.

ANIMAL HUSBANDRY: The production and care of domestic animals.

ANIMAL TRACTION: The use of animals to draw farm equipment, such as work-oxen plowing.

ARABLE: Usually refers to crops seeded and grown annually, such as small grains; can also refer to land fit for cultivation.

AREA: The number of square units that fill the interior of a closed figure. Calculated by multiplying the length times the width. The area of a garden is useful to know in garden planning.

ARID: Without moisture, excessively dry, parched and barren. Having insufficient rainfall to support agriculture without irrigation.

BACTERIA: Microscopic single-celled organisms.

BASE: See Alkaline.

BUND: A wall of soil used to control water flow in irrigated fields, as in rice plots.

CALORIES: Energy-producing value in food.

CARBOHYDRATE: Sugars and starches produced by green plants and used for growth or stored for future use. Important energy producers in human nutrition.

CARBON DIOXIDE: Odorless, colorless gas exhaled by humans, absorbed by plants, used by plants in photosynthesis.

CASH CROP: A crop produced for market, usually grown in large quantities, such as coffee, cacao, rice, etc.

CHLOROPHYLL: The green coloring substance in plants essential for photosynthesis.

CLIMATE: The average weather conditions of an area, including temperature, humidity, wind and rain, etc.

COMPOST: A mixture of decayed organic material used for fertilizer

CONSERVATION: Planned management of a natural resource to prevent its destruction or depletion.

DECOMPOSER: An organism that helps to decay organic matter. Examples are certain bacteria and fungi.

DEFORESTATION: When forested areas are greatly used up or in danger of being totally destroyed.

DEPLETION: When a natural resource is used up more quickly than it can be replaced.

DESERTIFICATION: When land turns to desert through depletion of its nutrients, water and ability to support plant life.

DESSICANT: Something used to draw moisture away from another substance and in using parched rice when storing seed.

DISCOVERY LEARNING: Active learning through questioning and experimenting.

DRAIN: To carry away excessive water as in rice cultivation.

ECOLOGY: The relationship between living things and their environment.

ECOSYSTEM: All the living things in a region that depend upon one another and their environment.

ENVIRONMENT: All the things and conditions around the place where an animal, plant or person lives.

EROSION: When soil is worn away and removed by water and wind.

EVAPORATION: When water changes from a liquid to a gas.

EXPERIENTIAL EDUCATION: Learning through direct experience.

EXPORT: A product sent out of a country for sale abroad.

FALLOW: Land left uncultivated for a period of time to allow vegetation to grow and replenish nutrients in the soil.

FIBER: A thread or rope-like substance in some plants.

FLAT BED: A garden bed whose planting surface is level with the original ground. Good for dry season gardening or plants that can tolerate wet soils.

GERMINATION: When a seed begins to sprout and grow.

GRAINS: Seeds of cereal plants; for example, rice, millet, wheat.

GULLY EROSION: Water run off creates small ravines carrying away valuable topsoil.

HYBRID: An offspring of two plants of different varieties.

IMPORT: Goods brought into a country from other countries.

INORGANIC: Not plant or animal.

INTEGRATED CURRICULUM: Bringing all of the subjects taught in school together in an interrelated way as in teaching math, science, social studies, English language and health in the school garden.

K: See potassium.

LEACHING: When water moving through soil removes nutrients.

LITMUS PAPER: Used to test pH.

LOAM: A rich soil of clay, sand and organic material.

MALARIA: A disease caused by the bite of a mosquito, characterized by chills, fever, aching joints and headache.

MINERALS: Inorganic components of soil.

MOSQUITO: Biting insect which can transmit diseases such as malaria and dengue fever.

MULCH: Placing straw or similar material around garden plants to prevent water evaporation and erosion. Also helps in controlling weeds.

N: See nitrogen.

pH: A chemical symbol that refers to acidify or alkalinity.

PARALLEL LINES: Two or more lines that run side by side and never meet.

PERIMETER: Measurement of the distance around an area, such as the perimeter of the garden.

PHOSPHOROUS: A soil nutrient essential for strong roots, disease resistance and fruit development in plants.

PHOTOSYNTHESIS: The process by which plants produce sugar and starch. Sunlight acts on the chlorophyll in the plant's leaves, changing water and cardon dioxide into carbohydrates.

PHOTOTROPISM: The ability of a plant to turn toward light.

PISTIL: Female part of a flower that carries pollen to the ovary.

PLANTATION CROP: A crop grown in a large area, usually for sale as market produce or for export. For example, coffee, cocoa, oil palm or pineapple.

POLLEN: Yellow, power-like male sex cells on the stamen of a flower.

POLLINATION: When pollen enters the ovary of a flower.

POROSITY: The ability of soil to absorb water.

POSITIVE REINFORCEMENT: To encourage a desired behavior by reward, praise or merit.

POTASSIUM: (Also called potash.) A soil nutrient essential for plant strength.

PROPAGATION: Producing new plants from old by seed multiplication or plant cuttings, etc.

PROTEIN: A nutrient essential for healthy cell growth in humans; contained in beans, groundnuts, beef and fish.

PUNITIVE: Punishment.

RAISED BED: Planting area ploughed and heaped so that the surface is 4-10 inches higher than ground level.

REFORESTATION: Planting of trees in areas stripped of trees and bush. Important to the ecological survival of most of Africa.

RIDGE: A planting area 8-12 inches high and a foot or two wide. Good for root crops or areas with poor drainage.

RILL EROSION: Erosion caused by concentrated water run-off, producing small channels or rills in a field.

SALINITY: The amount of salt present in a soil.

SCHISTOSOMIASIS (BILHARZIA): A serious disease affecting the urinary tract, bowels or nervous system. The schisto parasite is harbored by snails living in water containing the urine of a person with schisto. It is contracted by contact with water where the snails live. Teach children not to urinate in rivers or watersites.

SEEDBED: A bed for nursing seedlings which will later be transplanted, such as tomatoes, garden eggs or pepper.

SHEET EROSION: As water runs off bare ground, soil is carried away. The first state of erosion.

SLOPE: The incline of land that is not level.

SOIL PROFILE: Physical and chemical composition of a soil, including depth of topsoil, sand, silt and clay and the amounts of nitrogen, potassium and phosphorus present.

STAMEN: The male part of a flower which produces pollen.

STOMATA: The pores with which a plant breathes.

SUNKEN BED: A planting area so that the surface is below ground level.

SUBSISTENCE AGRICULTURE: Agriculture which feeds the farmer and his or her family, but does not produce enough for significant marketing or farm expansion.

TAP ROOT: Main root of a plant growing almost vertically downward.

TRANSPIRATION: When a plant gives off water from its pores.

TRANSPORTATION: The movement of water and nutrients through a plant.

VECTOR: A disease-carrying organism, such as the malaria-bearing mosquito.

VIABLE: Able to live or grow; for example, a viable seed.

VITAMIN: A substance in food essential to good health.

WHOLE CHILD: The total emotional, intellectual and physical child.

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